論 文 の 内 容 の 要 旨

論文題目　Relationship of Compact City to Quality of Urban Life
（都市生活の質に対するコンパクトシティの関係性評価）

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More and more cites, despite interminable debate so far on the untested paradigm of urban sustainability from the compact city, have adopted the compact city policies both in developing and developed countries, including Japan, since the compact city implementation has been believed to have positive effects on urban economy, society and environment, hence improve the quality of urban life (QOUL). There nevertheless has been no quantitative research testing the relations of the compact city to the quality of urban life, which is very essential research for urban planners, municipal governments and scholars to support or reconsider current compact city policies popularly implemented over the world.

This doctoral study is endeavours to fill up that deficiency, the absence of the research about relations between the compact city and QOUL with following objectives: (1) developing new index to quantify compactness of physical urban form at the view points of the compact city concepts, (2) measuring QOUL by objective and subjective evaluations, and finally (3) analysing the relationships of the compact city to QOUL.

Chapter 1 introduces the backgrounds with regards to the compact city and quality of urban life. The compact city has for decades been one of the most discussed topics in urban fields whilst being perceived as a sustainable urban concept. The concept is to promote high density, mixed land-use and public transport systems thereby encouraging walking and cycling, and reducing energy consumption. Considerable studies have claimed the benefits of the compact city policies; but at the same time there have been studies arguing the adverse effects of the compact city, especially with regards to high density.

Chapter 2 covers the literature reviews on the compact city and QOUL studies prior to developing the corresponding evaluation methodologies.

With regard to the compact city measurement, in chapter 3, it is developed the compact city index (CCI) to measure physical urban forms based on three common characteristics of the compact city that past researchers have so far defined: (1) high density, (2) mixed land-use and (3) sustainable transport that provides high accessibility to local services and jobs to promote a walking and cycling urban environment. CCI estimates how well a city have achieved those common characteristics at both community and city level.

First, CCI, at community level, evaluates station-based communities in a city from following three aspects: (1) the number of facilities in public transport station area, (2) the number of population who can access on foot to both the station and facilities (of (2)) and (3) the proximity between the station and facilities. A desirable well-constructed station-based community is therefore where abundant facilities and amenities are closely located to the public transport station and most of people reside in the station area hence gaining high proximity to both the station area and facilities. That concentration of the population and facilities in a station area is formulated as 'compactness to station (CTS)'. Second, at city level, CCI accesses accessibility to the city centre through public transport system. The formula 'compactness to city centre (CTC)' estimates how each station-based community is physically close to the city centre thereby making the bustling city centre both employment and habitation are concentrated while playing a role of "powerful engine". CCI is a composite function of CTS and CTS with the following variables: the percentage of population within 600 metres (10-minute walking distance) from a station, the percentage of population within 600 metres from a facility, the number of stations in a city, the number of facilities in a station area, the distance between the station and facility in a community, and the distance between a station and the city centre.

CCI, prior to its application to actual cities, is examined the sensitivity analysis through numerical simulations that change every factors of the CCI using various hypothetical urban forms. Simulation 1 changes the number of stations with three different assumptions when a city builds a new station. The new build station's population is composed of the in-migrants from: (1) other station areas in a city in simulation 1-1, (2) outside of station areas in the city and (3) everywhere in a city. Simulation 2 changes the population ratio of a station-based community. Simulation 2-1 assumes equal population in the communities and simulation 2-2 does unequal population. Simulation 3 changes the distance: distance to the city centre from a station in simulation 3-1 and; distance to the station from the facilities in a community in simulation 3-2. Lastly simulation 4 changes the number of facilities in station-based communities. Of the highest interest is simulation 1 since it has been the vaguest part in CCI formula interpretation whether it increase CCI or not; but the simulation result shows CCI is not influenced by the number of stations. Other simulations, 2, 3 and 4, also show that CCI have no critical biased sensitivity to corresponding factors.

CCI, as it is attested to a rational methodology for a practical use, is applied to 41 Japanese core cities, the middle-sized cities with populations ranging from 0.28 to 0.67 million. Every target city was a ‘core city (chukakushi in Japanese)’, an administrative category for the middle-sized city in Japan, at the year of 2008. Those cities further have had monocentric urban structures that CCI calculation is applicable to. Seventeen types of facilities closely related to quality of life are selected along with large-scale retail stores. Regarding public transports, only railways stations are employed. CCI is originally formulated to measure accessibility and population by distance and ratio respectively; but, as time and number itself are important measurement of the accessibility and population, it is computed totally four kinds of CCI with those different measurements. Four CCIs yet show no significant differences amongst their ranks of the target cities. Population density has been recognised as one of the possible factors that denote a compact city, but the results indicate that population density itself cannot represent compactness based on networked transportation. The findings also suggest that a city is able to achieve urban compactness or high accessibility in terms of time by means of high-speed trains or the installation of trams such as light rail transit.

Quality of urban life (QOUL) measurement, as a next step, is conducted by objective and subjective evaluation methods in chapter 4. Considering current Japanese urban context along with the data availability, totally 30 indicators are collected in economy, society and environment domains through careful investigation whether the indicator have significant difference between cities or not, by analysing its distribution. Those indicators compose six QOUL components by principal component analysis (PCA): (1) C1: industrial activity (productivity), (2) C2: educational environment (human resource or social level), (3) C3: deteriorated living environment, (4) C4: population and crowdedness, (5) C5: commercial and business environment and (6) C6: vitality-loss (depression). Population and crowdedness (C4) indicates significant Spearman's rank correlation coefficient with CCI as it is related to the compact city characteristics. It is remarkable that CCI also has a significant correlation with deteriorated living environment (C3) at weak confidence level.

Cluster analysis is conducted with the principal component scores as a further study. Firstly a hierarchical method defines the number of clusters then k-means procedure forms clusters. As a result, five clusters are formed with classifying 10, 3, 8, 11 and 9 cities to each cluster. Based on their QOUL characteristics, the clusters are interpreted as follows: (1) general core cities, (2) manufacturing cities, (3) satellite cities, (4) autonomous cities and (5) declining cities. Of high interest, those clusters share not only homogeneous QOUL characteristics but also similarity of CCI ranks, physical urban compactness. ‘Satellite cities’ and ‘manufacturing cities’ show high CCI ranks whereas ‘autonomous cities’ tend to rank the lower.

Subjective QOUL is evaluated by conducting structural equation modelling (SEM). Utilising objective QOUL components, identical subjective QOUL factors are employed to test how much objective attributes can predict subjective ones in QOUL. Those subjective QOUL factors are then linked to the total life satisfaction to analyse their causal relationships. Each subjective QOUL factors are estimated by questionnaire survey on the internet, which samples 2,050 people in equal ratio across the 41 cities, gender and five age groups (the twenties, thirties, forties, fifties, and sixties or older). According to the results, all objective QOUL components, excluding commercial and business environment, significantly predict corresponding subjective QOUL factors, but the prediction levels are weak. Amongst the subjective QOUL factors, living environment, commercial and business and vitality significantly predict total life satisfaction.

Post hoc analyses model-fitting procedure is carried out whilst respecifying and reestimating the initial model to establish more well-fitting model. The modified model results reveal that subjective QOUL factors are deeply related to 'vitality' perception. Perception of the commercial and business environment, and living environment have significant causal relationships to total life satisfaction. CCI, as it have significant correlations with perceptions of 'vitality' and 'commercial and business environment', is apparent that the compact city characteristics positively impact on subjective QOUL.

In conclusion, chapter 5, perceiving the compact city concepts definitely improves personal life satisfaction. Furthermore, actual objective urban compactness (CCI) significantly predicts compact city perception, which indicates strong correlations with subjective QOUL attributes, particularly associated with commercial and business environment, and vitality. The findings of this study, in order to improve both objective and subjective QOUL, imply that compact city implementation ought to be along with the effort to increase urban vitality, especially with sufficient young generation. Compact city implementation only deals with physical built environment to upgrade QOUL, but the compact city would play a more crucial role to revitalise a city when it comes with endeavour to boost the ratio of young generation.